Supplement to HART® Communicating Fisher® FIELDVUE® Digital Valve Controller Instruction Manuals

Using the HART® Tri-Loop™ HART-to-Analog Signal Converter with Fisher® FIELDVUE® Digital Valve Controllers

Tri-Loop™ Signal Converter Operation with FIELDVUE® Digital Valve Controllers

The Rosemount® 333U (alarm high) and 333D (alarm low) HART® Tri-Loop™ HART-to-Analog Signal Converter is used to read values from the digital valve controller and present them as 4 to 20 mA signals accessible to AI channels on traditional host systems. This device accepts a HART burst command 3 from a smart instrument and converts it into up to three 4 to 20 mA analog output signals. The output signals then can be read by a control system's analog input channels. See table 1 for command 3 variables.

Figure 1 shows a typical installation of the Tri-Loop signal converter with a digital valve controller.

The Tri-Loop signal converter may be used with the following FIELDVUE digital valve controllers:

- DVC5000 Series digital valve controllers with firmware revision 5, hardware revision 5 or newer. (DVC5000 Series digital valve controllers with firmware revisions earlier than revision 5 do not support burst mode communications. Instruments with firmware revision 5 and hardware revision 4 are not recommended for use with the Tri-Loop signal converter.)
- DVC6000 Series digital valve controllers, or
- DVC2000 Series digital valve controllers.

The Tri-Loop signal converter outputs will go to their fail state when any of the following occur:

- there is a loss of burst mode communication from the smart instrument

Table 1. Command 3 Variables(1)

TYPE	VARIABLE	VARIABLE NAME	RANGE
DVC5000 Firmware 5	Primary	Travel	0 to 100%(2)
	Secondary	Travel Target	0 to 100%
	Tertiary	Pressure	0 to 100 psi
			0 to 6.9 bar
			0 to 690 kPa
	Quaternary	Auxiliary Status	Either 0 or 100%
DVC5000 Firmware 6	Primary	Travel	0 to 100%
	Secondary	Travel Target	0 to 100%
	Tertiary	Pressure	0 to 100 psi
			0 to 6.9 bar
			0 to 690 kPa
	Quaternary	Drive Signal	0 to 100%
DVC6000	Primary	Analog Input	4–20 mA or 0 to 100% depending on instrument configuration
	Secondary	Travel Target	0 to 100%
	Tertiary	Pressure (Supply or Output)(3)	0 to 100 psi
			0 to 6.9 bar
			0 to 690 kPa
	Quaternary	Travel	0 to 100%(2)
DVC2000	Primary	Analog Input	4–20 mA or 0 to 100% depending on instrument configuration
	Secondary	Travel Target	0 to 100%
	Tertiary	Pressure (Output)	0 to 100%
			0 to 6.9 bar
			0 to 690 kPa
	Quaternary	Travel	0 to 100%(2)

1. AC tier does not support HART Command 3 or Burst Mode communications.
2. 0% valve travel is the zero control signal position for DVC5000 firmware 5, DVC6000, and DVC2000.
3. DVC6000 HC tier does not provide Supply Pressure.

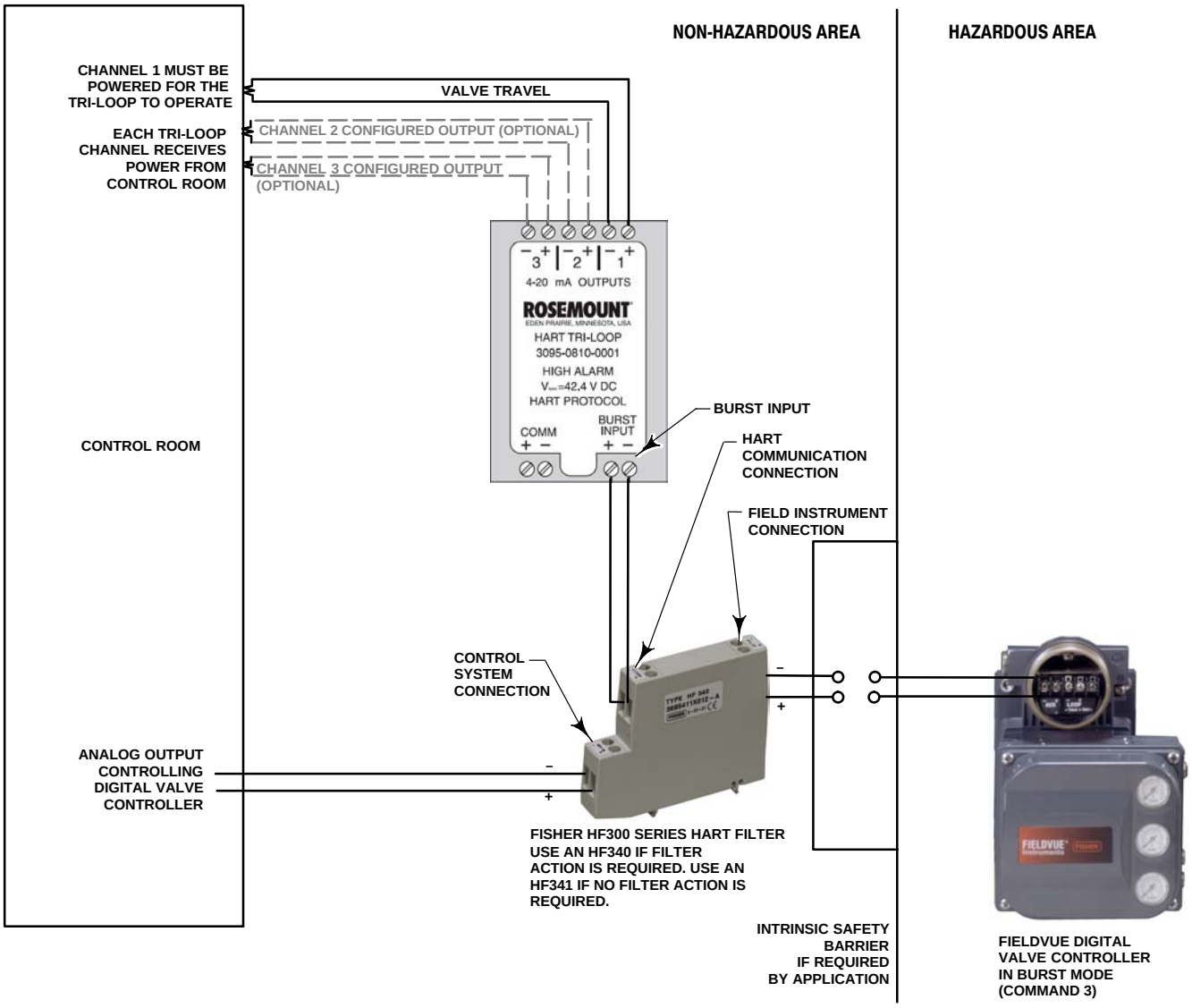
NON-HAZARDOUS AREA
HAZARDOUS AREA
CHANNEL 1 MUST BE POWERED FOR THE TRI-LOOP TO OPERATE
VALVE TRAVEL
EACH TRI-LOOP CHANNEL RECEIVES POWER FROM CONTROL ROOM
CHANNEL 2 CONFIGURED OUTPUT (OPTIONAL)
CHANNEL 3 CONFIGURED OUTPUT (OPTIONAL)
4-20 mA OUTPUTS
ROSEMOUNT
HART TRI-LOOP
3095-0810-0001
HIGH ALARM
HART PROTOCOL
COMM
BURST INPUT
BURST INPUT
HART COMMUNICATION CONNECTION
FIELD INSTRUMENT CONNECTION
CONTROL ROOM
CONTROL SYSTEM CONNECTION
ANALOG OUTPUT CONTROLLING DIGITAL VALVE CONTROLLER
FISHER HF300 SERIES HART FILTER
USE AN HF340 IF FILTER ACTION IS REQUIRED. USE AN HF341 IF NO FILTER ACTION IS REQUIRED.
INTRINSIC SAFETY BARRIER IF REQUIRED BY APPLICATION
FIELDVUE DIGITAL VALVE CONTROLLER IN BURST MODE (COMMAND 3)

Figure 1. Example HART® Tri-Loop™ HART-to-Analog Signal Converter Installation with a FIELDVUE® DVC6000 Digital Valve Controller

- there is a device malfunction reported by the smart instrument, or

- there is a loss of power to channel 1 of the signal converter.

Loss of power to channel 1 will cause all channels to go to their fail state. Loss of power to either channel 2 or 3 will not affect the remaining channels.

When in its fail state, a 333U signal converter generates a current of 21.75 mA or greater. A 333D generates a fail state current which is less than 3.75 mA.

The Tri-Loop signal converter is not recommended for FIELDVUE digital valve controller applications involving:

- split-ranging, or

- multi-drop (digital set point)

Table 2. Tri-Loop™ HART®-to-Analog Signal Converter Configuration Choices(1)

TRI-LOOP MODEL	FAIL STATE	CHANNEL(2)		
		1 (Travel)	2 (Travel Target)	3 (Not Configured)
333D	Low	0 to 100%	0 to 100%	Disabled
333U	High			

1. Tri-Loops pre-configured for use with DVC5000 digital valve controllers are configured differently than those pre-configured for use with DVC6000 and DVC2000 digital valve controllers.
2. Configurations of channels are preset, but can be changed with the 275 HART Communicator, the 375 Field Communicator, or AMS Device Manager.

Installation Considerations

The Tri-Loop HART-to-analog signal converter design allows three different din-rail mounting options:

- Asymmetrical 32mm G rail
- Symmetrical 35 x 7.5 mm top hat rail
- Symmetrical 35 x 15 mm top hat rail

As shown in figure 1, the signal converter must be installed on the safe side of an Intrinsic Safety (IS) barrier. It is approved for FM and CSA ordinary location, and bears the CE marking to indicate compliance with applicable EC directives. It is not approved nor designed for nuclear-qualified applications.

Figure 1 also shows a HART filter as a convenient connection point for the two additional connections to the loop wires. The necessity of a HART filter depends upon the control system; the Tri-Loop signal converter does not add a requirement for a filter. If a filter is required, the HF340 din rail mount filter provides a convenient method for connecting field wiring between the control system, the signal converter and the digital valve controller. If no filter is required, the HF341 is available without filter action (straight-through).

Tri-Loop™ Signal Converter Configuration From Fisher

The Tri-Loop HART-to-analog signal converter ships from Fisher pre-configured with one of the choices listed in table 2. As shown in the table the unit is available with either a high or low fail state. The channel 1 variable is always travel and the channel 2 variable is always travel target. Channel 3 is disabled, but can be configured by the user, using the 275 HART Communicator, the 375 Field Communicator, or AMS® Suite: Intelligent Device Manager.

The burst message from FIELDVUE digital valve controllers configured for fail-open actuators associates 0% travel with an open valve. Therefore, channel 1 of the Tri-Loop should be configured to provide a 20 mA output when the valve is open and a 4 mA output when the valve is closed (range is 100 to 0 rather than 0 to 100).

Power Source

Each output channel on the signal converter connects to a separate control system analog input channel. Each channel operates on a terminal voltage of 11 to 42.4 VDC. The signal converter is powered from the channel 1 power source. Lack of power on channel 1 will produce error states on channels 2 and 3.

Enabling Burst Mode

For a FIELDVUE digital valve controller to communicate with the Tri-Loop signal converter, the burst mode must be enabled. You can use a 275 / 375 Communicator, AMS ValveLink® Software, or AMS Device Manager to enable burst mode in the digital valve controller.

To enable the burst mode when using a DVC5000 digital valve controller with the 275 / 375 Communicator, select *Main Menu* and *Detailed Setup*. From the *Detailed Setup* menu select *Mode* then *Burst.* When using a DVC6000 or DVC2000 digital valve controller with the 275 / 375 Communicator, select *Setup & Diag* and *Detailed Setup*. From the *Detailed Setup* menu select *Mode,* then *Burst*.

With ValveLink Software click the Detailed Setup icon, or, from the menu bar select *Instrument Setup,*

Detailed Setup, and *Instrument,* and then click the *Alert Record and Commands* tab.

Note

HART devices connected to an instrument which is actively using burst mode communication may experience some HART communication errors. You should not be concerned unless the errors do not clear after a few moments or if they disrupt ValveLink Software configuration, calibration, or diagnostic activities. If a disruption occurs, disable burst mode during these activities and turn it back on when completed.

Once burst mode is enabled, the digital valve controller will continue to burst HART command 3 until the burst mode is disabled. Even if instrument power is lost, the instrument will continue to burst command 3 when power is restored.

Troubleshooting

Refer to table 3 for Tri-Loop diagnostic status messages.

To reach the Diagnostic Status menu using the 275 / 375 Communicator, select *Diagnostics/Service, Test Device,* and *Status* (fast key sequence 1-1-1).

Other Tri-Loop parameters can be access using the 275 / 375 Communicator or AMS Device Manager. Refer to figure 2 for the 275 / 375 Communicator menu tree, and table 4 for the fast-key sequence.

Table 3. Tri-Loop™ Diagnostic Status Messages(1)

ERROR MESSAGE	INTERPRETATION
CH1 Burst mode variable 'Not a Number'	Not applicable to the digital valve controller (always "off")
CH2 Burst mode variable 'Not a Number'	
CH3 Burst mode variable 'Not a Number'	
CH1 Burst mode variable at saturation	
CH2 Burst mode variable at saturation	
CH3 Burst mode variable at saturation	
Burst mode message is invalid	Parity or checksum error with burst message
Burst mode message timeout	Tri-Loop not receiving burst command "3"
Non-volatile memory checksum error	Internal problem with the Tri-Loop
Field device reporting failure	"Device Malfunction" status from the digital valve controller
CH1 Channel output is fixed	Channel commanded into "Output fixed" mode
CH2 Channel output is fixed	
CH3 Channel output is fixed	
CH1 Burst mode message units error	Channel's units do no match digital valve controllers units
CH2 Burst mode message units error	
CH3 Burst mode message units error	

1. "ON" = error is in effect. "OFF" = error is not active.

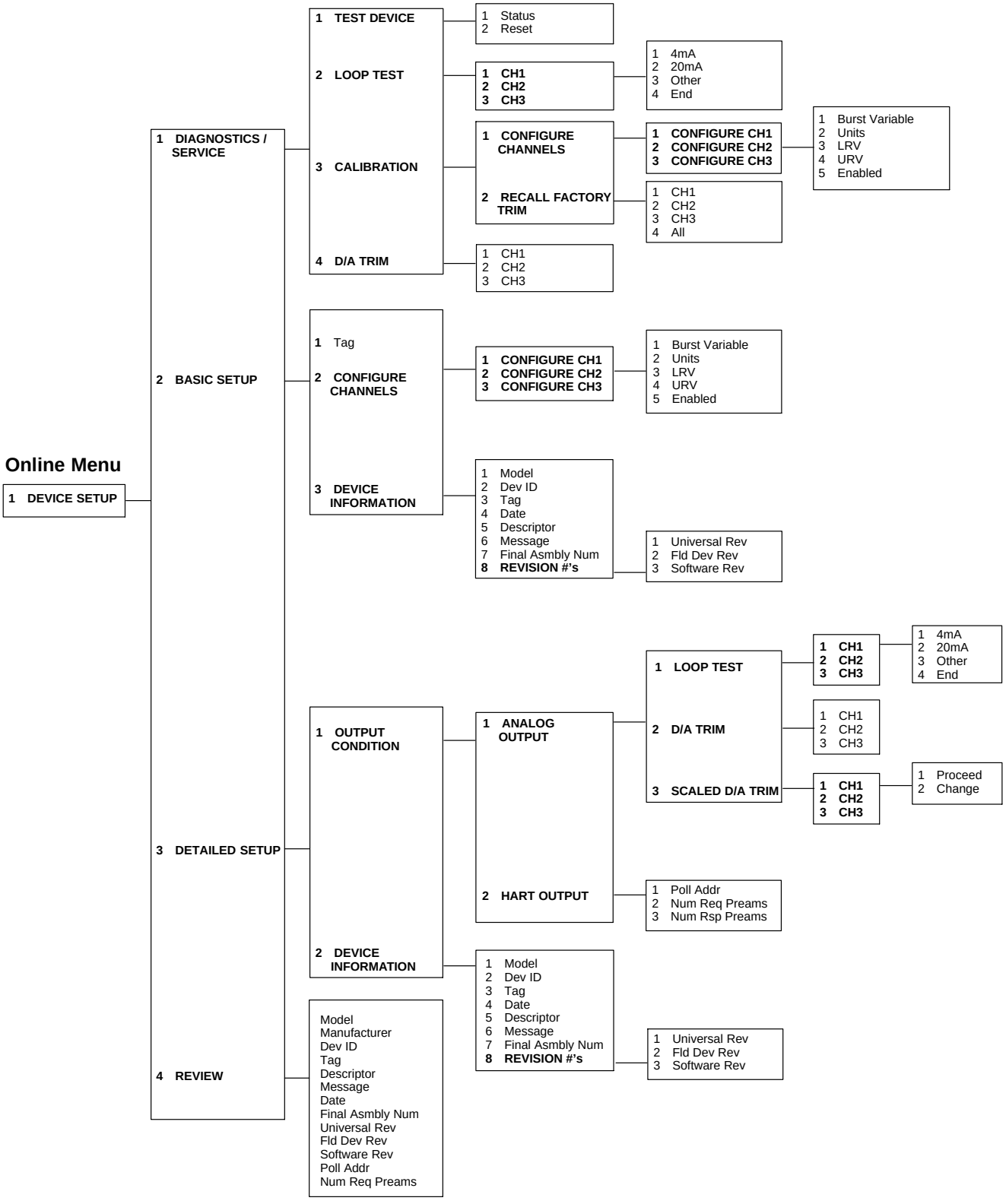

Figure 2. Menu Tree for the Tri-Loop™ Signal Converter

Table 4. Fast-Key Sequence for the Tri-Loop™ Signal Converter

FUNCTION	Fast-Key Sequence	FUNCTION	Fast-Key Sequence
20 mA (Loop Test)	1-2-1-2	Final Asmbly Num (Detailed Setup)	3-2-7
20 mA (Output Condition)	3-1-1-1-1-2	Fld Dev Rev (Basic Setup)	2-3-8–2
4 mA (Loop Test)	1-2-1-1	Fld Dev Rev (Detailed Setup)	3-2-8-2
4 mA (Output Condition)	3-1-1-1-1-1	LRV (Calibration)	1-3-1-1-3
All (Calibration)	1-3-2-4	LRV (Configure Channels)	2-2-1-3
Burst Variable (Calibration)	1-3-1-1-1	Message (Basic Setup)	2-3-6
Burst Variable (Configure Channels)	2-2-1-1	Message (Detailed Setup)	3-2-6
CH1 (Calibration)	1-3-2-1	Model (Basic Setup)	2-3-1
CH1 (D/A TRIM)	1-4-1	Model (Detailed Setup)	3-2-1
CH1 (Output Condition)	3-1-1-2-1	Num Req Preams	3-1-2-2
CH2 (Calibration)	1-3-2-2	Num Rsp Preams	3-1-2-3
CH2 (D/A TRIM)	1-4-2	Other (Loop Test)	1-2-1-3
CH2 (Output Condition)	3-1-1-2-2	Other (Output Condition)	3-1-1-1-1-3
CH3 (Calibration)	1-3-2-3	Poll Addr	3-1-2-1
CH3 (D/A TRIM)	1-4-3	Proceed (Scaled D/A Trim)	3-1-1-3-1-1
CH3 (Output Condition)	3-1-1-2-3	Reset	1-1-2
Change (Scaled D/A Trim)	3-1-1-3-1-2	Software Rev (Basic Setup)	2-3-8-3
Date (Basic Setup)	2-3-4	Software Rev (Detailed Setup)	3-2-8-3
Date (Detailed Setup)	3-2-4	Status	1-1-1
Descriptor (Basic Setup)	2-3-5	Tag	2-1
Descriptor (Detailed Setup)	3-2-5	Tag (Basic Setup)	2-3-3
Dev ID (Basic Setup)	2-3-2	Tag (Detailed Setup)	3-2-3
Dev ID (Detailed Setup)	3-2-2	Units (Calibration)	1-3-1-1-2
Enabled (Calibration)	1-3-1-1-5	Units (Configure Channels)	2-2-1-2
Enabled (Configure Channels)	2-2-1-5	Universal Rev (Basic Setup)	2-3-8-1
End (Loop Test)	1-2-1-4	Universal Rev (Detailed Setup)	3-2-8-1
End (Output Condition)	3-1-1-1-1-4	URV (Calibration)	1-3-1-1-4
Final Asmbly Num (Basic Setup)	2-3-7	URV (Configure Channels)	2-2-1-4

Related Fisher® Documents

- FIELDVUE® DVC5000 Series Digital Valve Controllers Instruction Manual

Note

The DVC5000 digital valve controller is obsolete. Contact your Emerson Process Management sales office if a copy of this instruction manual is needed.

- Bulletin 62.1:DVC6000 – Fisher® FIELDVUE® DVC6000 Series Digital Valve Controllers (D102758X012)

- Fisher® FIELDVUE® DVC6000 Series Digital Valve Controllers Instruction Manual (D102794X012)

- Fisher® FIELDVUE® DVC6000 Series Digital Valve Controllers Quick Start Guide (D102762X012)

- Bulletin 62.1:DVC2000 – Fisher® FIELDVUE® DVC2000 Series Digital Valve Controllers (D103167X012)

- Fisher® FIELDVUE® DVC2000 Series Digital Valve Controllers Instruction Manual (D103176X012)

- Fisher® FIELDVUE® DVC2000 Series Digital Valve Controllers Quick Start Guide (D103203X012)

- Bulletin 62.1:HF300 – Fisher® FIELDVUE® HF300 Series HART® Filters (D102798X012)

- Fisher® FIELDVUE® HF300 Series HART® Filters instruction manual (D102796X012)

Related Rosemount® Documents

For more information on the Tri-Loop HART-to-analog signal converter, refer to the following Rosemount documents, available from the Rosemount Measurement division:

- Model 333 HART® Tri-Loop™ HART®-to-Analog Signal Converter (product manual), Rosemount Document Number 00809-0100-4754

- Model 333 HART® Tri-Loop™ HART®-to-Analog Signal Converter (product brochure), Rosemount Document Number 00813-0100-4754

- HART® Communicator (product manual) Rosemount Document Number 00275–8026-0001

Note

The 275 HART Communicator is obsolete. Contact your Emerson Process Management sales office if a copy of this product manual is needed.

- 375 Field Communicator (user's manual), Rosemount Document Number 00375–0047–0001

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Instruction Manual Supplement

FIELDVUE® Digital Valve Controllers

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Emerson Process Management
Marshalltown, Iowa 50158 USA
Sorocaba, 18087 Brazil
Chatham, Kent ME4 4QZ UK
Dubai, United Arab Emirates
Singapore 128461 Singapore
www.Fisher.com

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